REINER GAMMA FORMATION FROM CLEMENTINE UV-VISIBLE SPECTRO-IMAGING DATA: THE LUNAR CHRONOLOGY AND IRON CONTENT. P. C. Pinet[1], V.V. Shevchenko[2], S. Chevrel[1] ([1] OMP/GRGS, 14 Av. E. Belin, Toulouse, 31400 France; pinet@pontos.cst.cnes.fr ; [2] Sternberg Astronomical Institute, Moscow, 119899, Russia).

A detailed remote sensing survey of the Reiner Gamma Formation (RGF) located in western Oceanus Procellarum has been carried out by means of Clementine spectro-imaging data with the purpose of establishing the regional distribution of the chronology index and weight percent of iron content in the lunar soils. The spectral dataset has been instrumentally calibrated and a radiometric calibration using previous telescopic spectra (7) has been made, resulting in the production of absolute reflectance spectra (1) organized in an image cube.

The spectral influence of both the soil maturity and iron content is quantified according to Lucey's method (2) and our previous analyses, based on the independent spectropolarization method (3,4), provide with soil maturity estimates in good agreement with the present results.

In fig. 1 is shown the plot iron content Fe versus maturity index Im where the values of Fe (weight %) for the Apollo and Luna landing sites are predicted from (2) and the values for Im are produced from the remote spectropolarimetric method (3,4). Im is equivalent to a rate of agglutinates and glassy fragments in the lunar surface soils. Its value ranges from 0 (start of regolith forming) to 1 (saturation of regolith by the amount of reworked particles). Though we use Lucey's approach, we recognize with (6) that the titanium content and the varying amount of opaque minerals such as ilmenite present in mare soils may affect significantly reflectance and spectral contrast. Consequently the notion of Fe content used here should be rather viewed as an indicator of surface composition dominated by FeO variations. According to this Fe content indicator, the data split into two different groups: mare and highland materials. It is worth noting that both types of material are present at the A15 and A17 landing sites. Fig. 1 shows that the predicted iron content is independent from soil maturation. It confirms that Lucey's empirical method for separating composition spectral influence from maturity spectral effect is reliable.

The diagram, depicted in Fig. 3, plots Lucey's parameters (θ or Fe content versus ρ (maturity index)). The spatial distribution associated to the greytone scale coded boxes (1 to 4) displayed in fig. 3 is shown in fig. 2b. It reveals the presence of extremely immature soils (coded in light grey) at the hundred meters scale in the Reiner Gamma Formation area (box 4). Also the soil iron content in the RGF area is higher (about 14%) than in the surrounding mare background soils (about 11-12%; box 1 coded in dark grey). This lateral variation might be related to the fact that RGF correlates with the magnetic anomaly detected by the Apollo magnetometers from the orbit.

Using similar Clementine data for ten other lunar regions of mare and highland types, we obtain on fig. 4 a scale of conformity between ρ and the Is/FeO index established by Morris (5). These quantities have a good linear correlation with r=-0.9. The Is/FeO values ranging from 20 to 80 correspond to exposure age from 10 to 100 million years. The most immature soils cover inner walls of young small craters of which the origin age may be equal to the exposure age of the surface layer on their inner walls and be as less as 10 Myr. The presence of very immature soils on the inner slopes and on the central peak of the crater Reiner suggests intensive slope processes.

The depth of crater Reiner is 2.4 km and its central peak height is 700m. Slopes are in the range 30-40°. The smallest craters seen in the image are about 400m in diameter with depth on the order of 80m. Inner slopes of walls for these small craters are up to 40°. The local ρ estimates points out at the occurrence of slope instability processes. Also, we note that the iron content estimates of these slope soils reach locally maximal values of 16%, with a systematic increase of Fe content with regolith depth for the investigated region.

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References: (1) Pinet, P.C. et al. (1995), LPSC XXVI, 1125. (2) Lucey, P.G. et al. (1995), Science, 268, 1150. (3) Shevchenko, V.V. et al. (1994), Sol. Syst. Res. , 27, 310. (4) Shevchenko, V.V. (1994), LPSC XXV, 1267. (5) Morris, R.V. (1978), Proc. LPSC IX, 2287-2297. (6) Fisher, E. and C.M., Pieters (1996), J.G.R., Vol. 101, N°E1, 2225-34. (7) Bell, J.F. and Hawke, B.R. (1987), Pub. of the Astronom. Soc. of the Pacific, 99, n§ 618, 862-867.

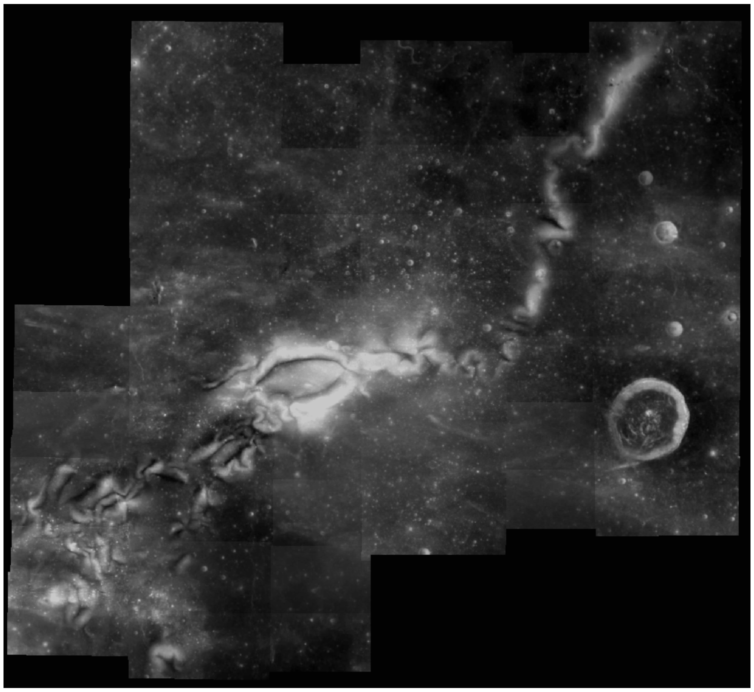

Fig. 2a

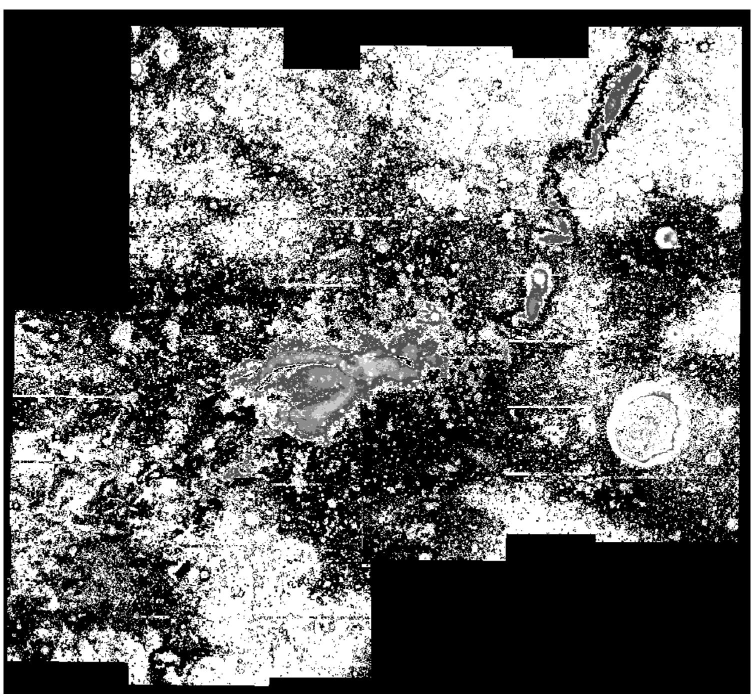

Fig. 2b

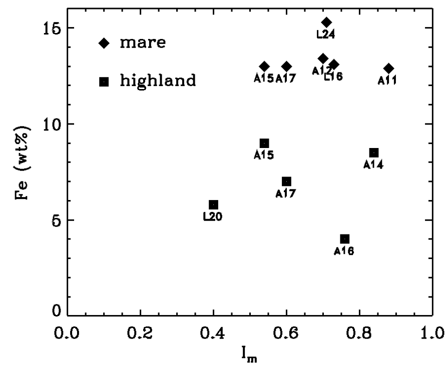

Fig. 1

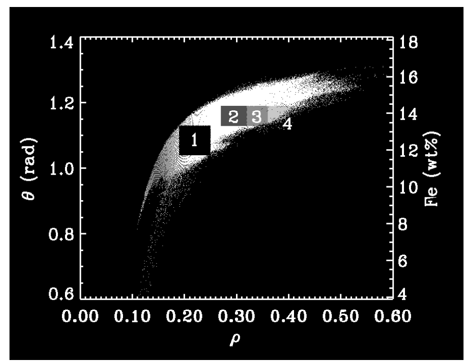

Fig. 3

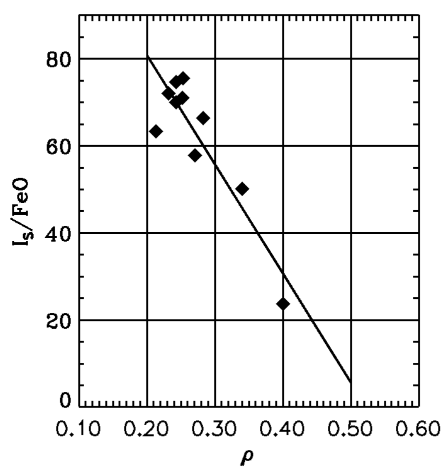

Fig. 4